

# :: BIOREPORTERS ::

## GENETIC ENGINEERED CELLS AND CELL SYSTEMS



### ■ Overview

Prokaryotic and eukaryotic cells respond to environmental conditions and stressors by a specific sequence of events at the genetic and molecular level. The genetic engineering of plasmids containing specific sets of promoter and response genes enable the stable transfection of these genes into different cell types. The stressor-response element can be turned on/off in a dose-dependent manner by exposure to the environmental stressor or inducer. Incorporating a reporter system such as Green Fluorescent Protein, Renilla luciferase, or LacI/LacZ as the response gene enables detection.

*Points of Contact:*  
*Dr. Steve R. Gonda*  
*Dr. Raimo Pollanen*  
*Dr. Ed Hudson*  
*Dr. Esfandiar Behravesh*

### ■ NASA Significance

The overall goal is to develop a set of benchmark bioreporters to study the effect of the space and planetary environments on living systems.

- provide sensing capability for a wide range of environmental stressors including various types of radiation, chemicals and gases.
- benchmark living systems as reporters will advance our understanding of the synergistic effects of multiple stressors on life in complex environments.
- explore concept for microgravity as a selective pressure on replicating cell populations.
- Sentinel systems to assess the compatibility of extraterrestrial environments with terrestrial life forms
- remote sensing systems for unmanned exploration

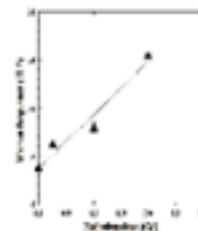
### ■ Development

- Cloning gene(s) of interest into appropriate expression vectors
- Inducible gene expression systems
- Transfecting prokaryotic and eucaryotic cells
- Developing benchmark panel of bioreporters for space and planetary stressors
- Establishing biosignatures and informatic systems to monitor space and planetary environments
- Significant benefits will be realized in savings of power, space, fluids and waste

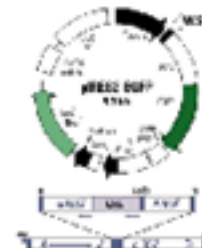
### ■ R&D Results

Mammalian cells were stably transfected with LacI and LacZ operons and exposed to high energy ionizing radiation for mutational investigations of space radiation.

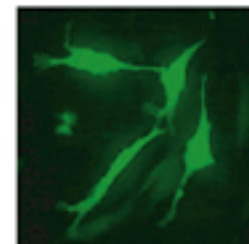
Mammalian cells were stably transfected with eGFP and eGFP fusion proteins for the investigation of molecular induction of gene expression in microgravity analog bioreactors.



Quantification of intended target



Transgenic targets



Stable transgenic cell lines